

ECCLES, (R. G.)

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Read before the Medical Society of the County of
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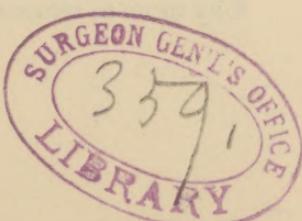
The doctrine of evolution is now accepted in all branches of biological science as the best available working hypothesis we have. As a guide to discovery in new fields, its results are simply marvelous.¹ Whether intrinsically true or false, its magic formula is the "Open sesame!" to myriads of nature's secrets we have no reason for believing could have been found out without it. The implications of the theory and the facts of the universe agree through the most minute ramifications and in the most diverse directions. The editor of the *Medical Record*, quoting from the *Lancet*, lately said: "To withdraw the conception of evolution from the domain of science, would now seem to us quite as impossible as to return to the Ptolemaic system of astronomy."² Our text-books on physiology have begun to accept it as the best means at hand of explaining the properties of the highly differentiated tissues of a human being.³ The irritability of an amoeba is the fundamental fact—the element so to speak—from which an explanation can be had of every property of the cells of our bodies. Slowly acquired and accumulated changes are supposed to have occurred that finally wrought nerves, muscles, ligaments, and bones from amoeboid little masses of protoplasm. At first indefinite in function, minute changes brought it into definiteness. Commencing incoherent in its parts as a monocellular being, it is assumed to have finally cohered as a polycellular one. At the beginning without definite organs and in the end wonderfully and complexedly organized.⁴ No one need believe man to be an aggregate of differentiated amoeba who does not desire to do so. We need not even try to string our facts together by the evolution hypothesis if any person can think out a better one. To assert creation by some other plan than that of evolution means nothing, unless the plan is told us so that we can compare it with the facts. If the universe, and all it contains, was framed by the word of God's power, what route did matter follow in obeying that

¹ Proc. Amer. Asso. Adv. Science, vol. 36, p. 1, President's Address.

² Med. Rec., vol. 33, p. 305.

³ Foster's Physiology, by Reichert. Introduction.

⁴ "First Principles," by Herbert Spencer, p. 396.



word? So long as we are able to make new and useful discoveries by the aid of the theory of evolution, would it not be the height of folly to give way to the prejudices of people who have not themselves an idea on the subject that they dare to formulate. What if we do discover that we look as if evolved from brutes. It does not, therefore, necessarily follow that appearances are correct. If the Supreme Power saw fit to form all things into a harmonic whole looking like an evolutionary one down to the finest minutiae, what harm could there be in our discovering this fact? It does not necessarily follow that we are descendants of quadrupeds, amphibians and fishes, because the arrangement of things suggests that as the most probable explanation. We have not the making of the arrangement and so must take it as we find it. Who knows *how* the Almighty formed the universe? There is but one way to find it out, and that is by studying the universe! This study, so far as it has gone, reveals a connected total and tells of relations such as would be found if evolution had wrought it. New discoveries may yet appear of a different order, and then we must find a different working hypothesis. Till then that man is foolish who refuses to use the only plausible, provisional explanation yet given. Let objectors either provide better or use it.

To-night we propose to test this theory of Descent upon some disconnected facts of pathology and observe its power to unify them. Should we only be able to succeed in bringing partial harmony out of a mass of discord, the pleasurable excitement of the result will be ample compensation for our pains. Possibly the new standpoint from which we view them may prove a vantage ground in the warfare we wage against disease, and the hints we derive be of use to us in our future work. In every department, where tested, this course has been unexpectedly successful, and we know of no reason why it should not be equally so here.

A vague, uncritical sort of belief in the hereditary transmission of disease tendencies has obtained among general practitioners for a long time. Few have dared to allow themselves to speculate upon the possibility of this chain of tendencies stretching back into the world of animated nature below us. No one has a due conception of the vast magnitude of the possibilities involved in so daring a speculation. Is there any reason for believing that a large number of weaknesses and disease tendencies of the human family are part of this great system that makes us appear as if we had descended from quadrupeds? What harm can it do for us to work on this assumption for awhile and see whether or not it will prove as fruitful to the pathologist as it has been to the botanist, zoologist and physiologist? Is it not the height of folly in us to refuse to do so? Our speculation cannot alter the facts

in the case. They will remain just the same when we are done as they were before we began. Should we in our eagerness to make the theory symmetrical distort the facts, the path of discovery will be closed to us. When a theory so distorted ceases its suggestiveness, as it certainly must, scientific workers no longer want it.

In considering the nature of the disease tendencies referred to, it requires no great prophet to see that we are on the verge of a mental revolution. If pathology follows in the wake of physiology in utilizing the doctrine of Descent, much contained in our present books on practice, gynaecology, and even surgery may become as antiquated as the chapters on phlogiston in old works on physics and chemistry.⁵ Etiology, which up to the present time has remained wrapped in darkness, may be expected to have a flood of light cast upon it. When leaders of medical thought say, that "Pathology affords scope for a far wider range of inquiry than has yet been bestowed upon it, and many of the problems which surround pathogenesis may find a solution in the observation of the lower animals, and in the facts of embryology,"⁶ it is easy to determine the tendency of the times. If pathology is deranged physiology, why continue longer to refuse studying the former by the same lights as we do the latter? We should look for some of the most persistent causes of disease along the route of apparent or real development from unicellular amoeba to the Caucasian race. Both as to our weakness and strength we should seek out the story heredity tells of the experiences of the lower animals as well as of our known human progenitors. Why we resist this disease and succumb to that depends mainly on our inherited forces. The study of these, how we came by them and what they are, should constitute a large part of the study of disease. To-day they are barely considered as to their existence and, among practitioners, not at all as to their genesis. The coming generation may wonder how we got along without knowledge as essential as it promises to be. A prominent American medical editor says: "Facts on all hands go to prove that in each individual there are certain constitutional peculiarities, congenital and not acquired, which govern not only the course and termination of disease, but likewise the susceptibility to its invasion."⁷ Bacteriological investigations have of late been pursued with less zeal than formerly, because they have failed to give medical science the full results promised at the outset by their ardent disciples. To distinguish between micro-organisms that are a cause and such as are but a consequence of disease is

⁵ History of the Inductive Sciences, vol. 2, p. 267.

⁶ Lancet, Feb. 27th, 1888, p. 406.

⁷ Jour. Amer. Med. Assoc., vol. x., p. 722.

one of the interesting problems now confronting us.⁸ Even those that are demonstrably pathogenic seem to be powerless without the co-operation of bodily conditions. Inherited tendencies control to a much greater extent than has been heretofore supposed. Innumerable points of weakness are blended with those of strength, and the law of heredity preserves the former with as much pertinacity as the latter, leaving to the principle of the survival of the fittest the improvement of affairs by a slow process of elimination. Our bodies bear many scars and partly functionless rudiments that look as if they had been the successors of organs and glands that once disappeared through inactivity. These are sometimes the seat of disease and harboring nests for pathogenic germs.

Our upright attitude is itself the cause of more ills and the exposure to strain of more points of weakness than at first thought would seem possible.⁹ We read that "God made men upright and perfect, but they have sought out many inventions."¹⁰ Yes. And a goodly number of these inventions seem to have been for the purpose of overcoming the evils of the upright position. Look at the great array of surgical and gynaecological appliances for the diseases we are about to consider, then deny who can. Unfortunately for the ladies, they seem to be greater sufferers than the men. However their structure may have been devised, or who or what the architect, their one essential distinctive organ that gives each the name of womb-man is hung as if they were first designed to go on four feet instead of two. Every one of the peritoneal ligaments occupies the best possible position for the suspension of that organ in a quadruped and the prevention of its pitching forward upon the diaphragm while in a gravid condition. The best supporting ones of them all give but a very imperfect support in an upright being. The round ligaments, especially, show the marks of utter uselessness in the human female while of the very greatest use to the lower animals. Mr. Rainey's guess that their utility may come in during coition is puerile, for such a strain could only eventuate in the hastening on of the diseases to which the organ is liable.¹¹ A mechanism primarily designed to lead to disease or that became selected because it led to disease and death would be an anomaly indeed. All these ligaments are to an inquiring mind notes of interrogation. If we ask ourselves whether they could not occupy positions very much

⁸ Vide Semmola's Address, Int. Med. Cong., in New York Med. Jour., vol. 46, p. 311.

⁹ American Naturalist, vol. 18, pp. 1-9.

¹⁰ Eccles., chap. 7, v. 29.

¹¹ Playfair's System of Midwifery, p. 62.

better for their owners, every unbiassed mind must, on the testimony of appearances, answer in the affirmative. When we try to conceive of a way whereby they could be improved for our wives, mothers, sisters and daughters, providing they always walked on "all-fours," we would be compelled to acknowledge ourselves beaten. Their directions are perfection itself for a quadruped, but extremely provoking if we want to believe them designed solely for the benefit of the human race. The inventive genius of man has long been at work, devising pessaries of every shape and form, to overcome what seems to be the faulty work of nature in putting ladies on two feet and weaving their uterine supports downwards instead of upwards, as we would have done had we had any say in the matter. What multitudes suffer in health and happiness from prolapsus, versions, flexions, and inflammations due mainly to our proudly erect attitude? How many infants' lives have been sacrificed to prolapsus of the funis, a thing unknown among quadrupeds? For reasons yet to be stated, it would harm them little if common. Where it is positively dangerous (*i. e.*, in the bimana) it is frequent. Where it would prove harmless (*i. e.*, in the quadrupeds) it never occurs. With woman it would not happen if she went on all-fours. When we undertake to restore the cord, we put her in that position.¹² Our gynæcologists have also discovered that when they try to get the uterus into its true position before applying an artificial support, the best way is to put the woman on her hands and knees with head and shoulders downward. In other words, she must assume the attitude of a quadruped before the ligaments will properly do their duties and swing it where it rightly belongs. These things show us that in pathology as in botany and zoology everything looks as if evolution had occurred from lower to higher forms. It is evident that the theory of Descent is a good working one, and able to throw new light on old facts.

Turning next to the consideration of some serious troubles that men are heir to as well as women, we are again confronted with the baneful results of the upright position. The torturing agony of piles and its frequently accompanying curse, prolapsus ani, constitute a couple of the penalties paid for the pleasures of walking on two feet instead of four. In the haemorrhoidal veins, valves would be useless to the lower animals, but in man their absence makes earth a living hell to multitudes. Many a human life has been lost by their absence, and many more must yet be sacrificed ere adjustment has become perfect to our manly attitude. But why are there no valves here? Why are the portal, iliac, venæ cavæ, and spinal veins, free from them? In

¹² Medical World, vol. 4, p. 409.

these, above all others, they seem to be most needed. We find them just as they should be in the legs and arms. Here they are useful to support the upward rising columns of blood. We find two in each of the jugulars, but in the reverse direction to which they should be placed. Fortunately for us, they work badly. We find each inferior thyroid obstructed by one at the junctions with the innominate. We find the intercostal veins well supplied, although they are as devoid of use to upright beings as the celebrated fifth wheel is to a wagon. When we lie on our backs or sides, they are worse than useless, as they hinder the flow of blood toward the azygos. Surely, an arrangement of this kind could not have been devised for the bimana. Put us on "all fours," and everything is immediately seen to be as it should. The jugular valves that are reversed in us are all right in the lemurs, whose long dependent necks often need an upright support for their blood, as it flows from the head toward the heart. Ours need no support in that direction, as gravity alone is able to draw downwards, to the full capacity of the veins, as fast as disposed of by the heart. Regurgitation upwards does not occur. While on our hands and feet, the intercostal valves work like a charm, supporting the blood upwards from the front of our chests toward the back, whither it travels. In this "all-fours" attitude we need no valves in the spinal, haemorrhoidal, or portal veins, and our *venæ cavæ* can also perform their functions without them. When we are so placed, they occupy a horizontal position instead of a perpendicular one. For the two appended figures and most of the material of this part of my paper, I am indebted to Dr. S. V. Clevenger's article on the "Disadvantages of the Upright Position"¹³

FIG. 1.—UPRIGHT.

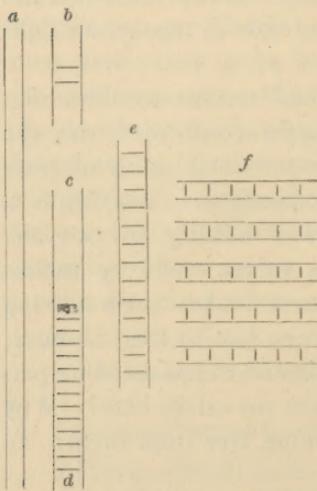
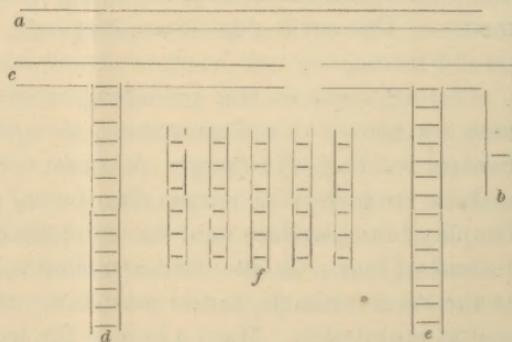


FIG. 2.—"ALL FOURS."



a = Spinal.
b = Jugular.
c = Caval.
d = Femoral.
e = Brachial.
f = Intercostal.

¹³ American Naturalist, vol. 18, pp. 1-9.

Fig. 1 shows how the valves are arranged while in an upright position. Fig. 2 shows their arrangement when we are on our hands and feet, with head down. In this last position they are all right. In the former, most of them are wrong.

From quadupeds, through monkeys, Negroes, Mongolians, and Indians, to Caucasians, there is a constant decrease in the size of the pelvic outlet, and a corresponding change in the shape of the pelvis. The antero-posterior or conjugate diameter averages less for women of the same size in the white race than any other. The pressure constantly exerted by the weight of the upper part of our bodies upon the bones of the pelvis has successively seemed to change the cuneiform outlet of the Negro into the square of the Mongolian, the round of the Indian, and finally the oval of the Caucasian. The weight and volume of the pelvic organs appear to have altered the box-shaped pelvis of quadrupeds into the wedge-shaped one of man. Every difference between the pelvis of a four-footed animal and that of a Caucasian is just what we should expect to occur under an incessant strain with conditions as they are. The intermediate steps exist in the colored races. The known laws of animal mechanics show just how it occurs. Our inheritance of uprightness seems destined more and more to narrow the pelvis of our women in this same manner. This we might contemplate with complacency if our heads diminished in size correspondingly. Unfortunately the reverse is true. As time rolls on, the conditions of propagation seem destined more than ever to become embarrassed and the race to be less prolific. The lower races of men are free from such delivery troubles as fill our birth chambers with the long protracted, agonizing cries of maternity. Their heads are smaller and the outlet to their pelvis larger. Uprightness and progression demand fearful penalties. Long protracted delivery, lacerated cervix, torn perinæum, prolapsed uterus, and a host of reflex neuroses, are the grim death skeletons that mock us in our upward struggles. Dr. Clevenger philosophises thus upon the matter: "If we are to believe that for our original sin the pangs and labor at term were increased, and also believe in the disproportionate contraction of the pelvic space being an efficient cause of the same difficulties of parturition, the logical inference is inevitable that man's original sin consisted in his getting upon his hind legs."¹⁴ This kind of sin brought many other troubles on man besides the pains and accidents of childbirth. The little one after birth, even if subject to rachitis, is by its mother's anxiety hurried up in its efforts to become such a sinner, the result of which is an inheritance of crookedness. It is forced to go through life wobbling

¹⁴ American Naturalist, vol. 18, p. 7.

along bow-legged. Had it been kept longer as with four-footed creatures, the symmetry of its perpendiculars would not have been destroyed. Possibly, too, such undue haste has much to do with the large number of cases of inguinal and femoral hernia. It is estimated that twenty per cent. of the human family suffer from the first in its two forms of oblique and direct. By strangulation, many cases terminate fatally. It does not require a long inspection of the anatomy of these maladies to discover how little the tendency would be to their formation if, like beasts, we kept on "all fours." From the earliest infancy an effort is made to have the babies sit upright. Who can tell how very much of this hernia has its origin at this time? The weakness that predisposes thereto is an inheritance, but the upright attitude is the exciting cause. Animals have the former, but not the latter.

In the lower animals weak points are guarded or occupy places out of reach of harm. The philosophy of evolution explains this as a survival of only those so guarded. Animals exposing to danger a point of weakness were killed, and only those that came into existence with proper guards survived to perpetuate their kind. Man is a notable exception to this rule. With him every point of danger is exposed while on his feet, but guarded when on his hands and feet. Arteries, as a rule, are placed deep down in the tissues and below the veins. In this way they escape accidents and injuries that would often prove fatal. One artery, the femoral, does not obey this rule. It is near the surface. Occupying the inner aspect of the thigh, it is completely protected in quadrupeds. In man it is fully exposed, and but for our intelligent ability to care for ourselves, it would cause the death of multitudes. As it is, in wars, quarrels and accidents, many lives are sacrificed to it. The same is true of the abdomen and its viscera. Rupture of the bladder, peritonitis and death are not unfrequently the results of blows upon this exposed part. In quadrupeds presenting a front aspect to an enemy, this region is well shielded. Beasts in attacking one another aim at each others abdomens, and strive to present the shield to their own with which nature has endowed them. In man the exposure is as complete as possible, and millions on the battle-field have been swept away thereby. Our bony framework has undergone so much change in its articulations and adjustments that dangers from special dislocations due to the upright position are few. The clavicle seems to be an exception. Those common to it in us are not likely to occur in quadrupeds. Dislocations of the sternal end throw it forward, backward or upward, and of the acromial end upon the upper surface of the acromions or upon the anterior part of the spine of the scapula. These are all in the opposite direction to which blows or strains would be applied in a quadruped. Downward dislocations,

the kind they would be liable to have, are next to impossible. Where they are safe we are exposed. The fact that the most common dislocation of the femur is upwards and backwards (*i. e.*, the ilio-sciatic) is significant.¹⁵ That is just what we might expect in assuming the upright position. As the hind legs of four-footed animals are not exposed to backward dislocations, but little special protection has been provided them in that direction. Lateral strains, however, are likely to occur. The protection sideways we would expect to be, as it is, good. In the upward position, downward dislocations are second in the order of frequency and lateral ones come last. All this shows that nature's guards are quadrupedal. The arms of man have undergone so many changes to suit them to his use, it could scarcely be expected that any simian or quadrupedal characteristics would be left behind. It is, however, a most remarkable fact that reduction of all humeral dislocations from muscular violence is now claimed to be best performed by putting the patient on his back and producing traction on the arm at right angles to the body.¹⁶

When the intestinal tube of man forgets proper behavior and tries to turn itself outside in, is there not some meaning to the fact that it usually does so from above downwards? If we went four-footed we would not suffer and die of intussusception. This disease, so often the opprobrium of the surgical diagnostician in his failing to determine it early enough, is best relieved by turning the patient into a position the reverse of that we are so proud of being able to occupy.¹⁷ Inversion is declared by some English authorities to seldom, if ever, fail when taken in time.¹⁸

It has been observed by botanists that the growing buds upon a developing tree struggle with each other, in their own silent method, for the sap or food upon which their continuous existence depends. In this struggle apparently trifling events will determine which bud shall secure the best supply and live. The final symmetry of the tree is due solely to the outcome of this warfare. Pressure on the bark below may divert the current from the most promising bud to one much less so, and change the whole future shape of the tree. Lines of foetal strain and pressure, in a similar manner, may be misdirected, and a monster result where should have been a beautiful babe. Pressure may partly or wholly occlude an artery or some capillaries leading in a certain direction, and development consequently be totally arrested

¹⁵ Erichsen's *Surgery*, vol. 2, p. 497.

¹⁶ *N. Y. Med. Jour.*, vol. 44, p. 44.

¹⁷ Erichsen's *Surgery*, vol. 2, p. 661.

¹⁸ *Lancet*, Jan. 16th, 1886, p. 88.

in that direction. The budding organ may have gone half, quarter, or three-fourths way through its intended changes toward perfection at the time. The force behind heredity being unequal to the task of removing the obstruction, a malformation results. Inflammatory action makes the occlusion complete and permanent. The new habit, vicious though it be, becomes fixed, and generation after generation gives rise to the same malformations, though the first cause is long gone. In ways like this came partitioned and bifid uterus, hare-lip, spina bifida, and a long list of the same kind. Our upright attitude and the upright attitude of pregnant women has for ages put a strain upon the capillaries of the region of the spine, that has tended to cut off the blood supply in the growing vertebrae. This has greatly increased the liability of human infants to have spina bifida. Among animals it is exceedingly rare along the back. Among human beings it is, alas! quite common. It is a daily saying that "there is no great loss without some small gain." Appearances indicate that to this disease, and the sacral curving from the weight of the upper part of the body, we owe our freedom from such a caudal appendage as is borne by most of our simian relatives. Such at least is the opinion of Prof. Lawson Tait, after studying into the subject.¹⁹ He investigated the history of the tailless cats of the Isle of Man, and carefully examined a kitten that had lost its tail through a badly developed vertebra giving way. He found evidence enough in these to make it somewhat probable to his mind that, if man's progenitors ever had tails, they lost them in some such manner. Be that as it may, the curving of the posterior part of the vertebra in man, and its necessary rigidity at that point, would make such a thing a very uncomfortable attachment, especially in sitting. If our ancestors never had anything of the kind, this part of our anatomy looks very much as if they had. There are in the waters of the Mammoth Cave, fish that cannot see. Where other fish have eyes, they are without them. Dimpled scars exist just where the eyes should be found. They are most marked in the young ones, but quite plain in the old. Occasionally one is found in which they barely show. Atrophied organs of this kind are not uncommon among the lower animals. A very curious dimple exists in about fifty per cent. of the human race just where we would expect a scar from a lost tail. It is there in both sexes, but more marked in women, and especially well marked in babies. As the eye dimples in the eyeless fish seem to indicate that their progenitors had eyes, so the dimple that lies posterior to the anal orifice of so many of us looks as if tails had once been fashionable. In actual fact, however, we all have a rudimental one buried in

¹⁹ *Nature*, vol. 18, p. 481.

the tissues. The os coccyx is as surely a tail, even if it is very short, as the longest one borne by a spider-monkey. At rare intervals, rever-sions occur to ancestral types, and the Mammoth Cave fish come into existence with imperfect eyes. Occasionally a similar reversion seems to occur in men, and they are born in actual possession of an extension of the coccyx of several vertebræ, making quite a decent caudal appendage.²⁰ The young whalebone whales have teeth in foetal life, but, being useless to them, they are absorbed before birth. Their near zoological relatives have teeth. Occasionally one of these whales comes into actual life bearing these pearls in its mouth. Between the fourth and twentieth weeks of gestation, the human foetus has absorbed four extra joints below what becomes the coccyx. Somebody should have the kindness to read a meaning into these other than an evolutionary one. If the whalebone whale's teeth mean that their ancestors had teeth after birth, would it not seem that the absorbed extra vertebræ of human beings meant that their ancestors once bore these throughout life?²¹

Another rudimentary organ, which, like the terminal bones of the spinal column, is very much larger in foetal than actual life, is the appendix vermiformis. For the first four months it is continuous with the cæcum, as a cylindrical body like the small intestines. It is therefore originally one with the cæcum and a vestige of the alimentary canal. Like all rudimentary organs, its vitality being low, it constantly becomes smaller and smaller with age. In some it is only foetal, being absorbed before they are born. With others it is probably small at birth, as it has almost or quite disappeared at manhood. This proves it to have no necessary connection with the processes of life, and shows that such function as it may possess is scarcely worth considering.²² In herbivorous animals, as in the first weeks of foetal life, the cæcum and the appendix are one. In the rabbit a partial constriction separating the two is found.²³ Where no such division exists the cæcum, which with us is a mere rudimentary organ, is a large dilatation of the colon, connected with the intestines by small openings and forming the second stomach. It then almost fills the abdominal cavity, and has a capacity about twice as great as the stomach. If our ancestors once were closely related to the herbivora, they had a use for the cæcum and appendix. We have about as little use for them now as men have for mammæ or whalebone whales for teeth. That they secrete mucus or,

²⁰ Variation in Plants and Animals, vol. 2, p. 76.

²¹ Lancet, June 1885, p. 1178; Variation of Plants and Animals, vol. 2, p. 6.

²² Jour. Amer. Med. Assoc., vol. 11, pp. 40-46.

²³ Nature, vol. 8, p. 540.

in some instances, something else, proves no more than the fact that the masculine mammae do frequently secrete milk.²⁴ Such secretion is but the remnant of a function once necessary, now possibly supplemental or vicarious, but nothing more. The most common position of the appendix to the cæcum renders it often a very dangerous affair. Grape seeds, pebbles, and small, hard, indigestible substances, find their way into the little worm-like tube, where they set up typhilitis. This leads to perforation through bacterial action, and ends in peritonitis and death. None of us know how soon we may be the victims of this agonizing disease, brought on by what appears to be a mere shriveled remnant of a once highly useful organ. Here is a death-trap that looks as if it had been devised by Satan for our destruction, and without conceivable earthly use as a compensation. If the story of evolution is not true, it surely looks like a diabolical contrivance.

Beneath the deep cervical fascia in monkeys and some other mammals a large air-sac extends from the hyoid bone to the sternum and thence sideways to the axilla. In foetal development a corresponding diverticulum occurs in man, that seems to mark our connection with them in a common line of descent.²⁵ Imperfect closure of this arrangement in the human family becomes a very serious affair, producing, as it does, fistulas, dermoid cysts, hydroceles, and atheromas, according to the contents and degree of closure.²⁶ It is all very well for the quadrupeds to be blessed with these air-sacs, but why dangerous openings should occur in us along the very path and under exactly the same anatomical arrangements, is not easy to understand unless we accept the doctrine of evolution. There are a number of similar canals or passages like this which mark the places of parts functionally active in animals below us. Within these, congenital cystic tumors are of frequent occurrence. B. J. Bland Sutton, F.R.C.S., in a lecture at the Royal College of Surgeons, London, enumerates them as follows: "(1) The curious recess at the top of the pharynx, which brings the infundibulum of the third ventricle into relation with the buccal involution; (2) the neurenteric passage which brings the central canal of the cord and the alimentary canal into relation round the caudal end of the notochord; (3) the post-anal gut; (4) the bronchial arches; and (5) the developmental history of testis, ovary, and Wolffian duct."²⁷ Another one is found in the foetal tongue, running from the foramen cæcum to the origin of the middle portion of the thyroid gland. It is a favorite place for dermoid cysts. Then there is the œsophageal cæ-

²⁴ *Lancet*, July, 1886, p. 75.

²⁵ *Lancet*, Feb. 27th, 1886, p. 387.

²⁶ N. Y. Med. Jour., vol. 42, p. 18.

²⁷ *Lancet*, Feb. 27th, 1886, p. 387; Wagner's Pathology, p. 507.

cum of veterinarians. This is a blind pouch found in elephants, camels, hogs, etc. Dr. Albrecht, of Brussels, has traced it out as a remnant of the air-bladder of fishes. Its mark appears in the human embryo, and, although closed at birth, remains as a weak spot for the development of pharyngocoele.²⁸

We now come to one of the most curious implications of comparative anatomy and embryology. The development of the thyroid gland from the gills of fish at first sight looks very improbable, and yet the facts seem to point that way.²⁹ It is found in all animals down to the amphibia, where it disappears, gills taking its place. The structure is something like that of a gill. The blood supply is arranged in the way best adapted for aeration. The rudimental function still retained by it is just what might be expected from an atrophied and buried gill. In all cases of impeded respiration during running, carrying heavy loads, sleep, menstruation, pregnancy, etc., it supplements the work of the lungs. At such times it becomes highly congested and can in some persons be seen to stand out and pulsate like a great artery. Its blood supply is simply immense for so insignificant an organ, being more than all used for the brain. Its arterial branches break up into myriads of minute stems, which, entering its glandular structure, surround the lung-like alveoli.³⁰ It is evident that its function is not pressingly necessary in human beings, as some persons are born practically without it, a thin membrane occupying its site.³¹ Its removal in most cases produces no known ill effects, but in a large number myxoedema results.³² The production of this trouble from extirpation of the gland may be as purely reflex as that form of parotiditis, which is a common occurrence after various unlike operations upon and accidents to the pelvis and pelvic viscera.³³ Since some can live without a thyroid gland, why cannot all? If we all could enjoy life without it, why was it given to us? If it remains as a vestige of the breathing apparatus of our very remote ancestors, we can see at once its necessity. All such organs are needed to carry foetal development past the stage which represents their period of utility in actual life.³⁴ Heredity is repetition, and an animal that develops by the law of heredity must repeat the steps which produced it partially or wholly. The blood must flow through all the old channels before it can reach

²⁸ N. Y. Med. Jour., vol. 42, p. 17.

²⁹ American Naturalist, vol. 18, p. 3.

³⁰ Todd's Cyclopedia of Anatomy and Physiology, vol. 4, p. 1102.

³¹ Reference Handbooks of the Medical Sciences, vol. 3, p. 352.

³² Medical News, vol. 50, p. 74.

³³ Medical Times and Gazette, vol. 2, p. 290.

³⁴ Lancet, Feb. 20th, 1886, p. 375, and Jan. 9th, 1886, p. 86.

the place where it can begin to develop the new ones. If the thyroid gland is not an evolutionary product, its disease producing proclivities defy all teleological speculations on beneficence in the universe. That the human form divine should have been knowingly and wilfully constructed on a plan that would cause it to become horribly distorted in thousands because they happened to live in deep valleys or drink water impregnated with certain minerals, seems too monstrous to believe. To see a poor peasant woman in a Swiss canton with the largest volume of her neck hanging over her shoulder and supported in a bag, because she was born with an organ that is of questionable use to her, and that many of her fellows have lived and enjoyed life without, is not calculated to increase the reverence of an intelligent man who believes in special creations rather than universal biological laws. When we go farther and discover that the progeny of this poor goitrous woman is very likely to be composed of cretins, the matter becomes much more serious. It is bad enough to have her own neck deformed, but it is far worse to have her children grow up as drivelling idiots, with narrow flat heads, shrivelled, small brains, and not sense enough to keep their lolling tongues in their mouths or to wipe the flowing saliva from their slobbered faces. A few years ago statistics recorded fifty thousand living cretins in Europe, more than half of whom were traced to positively goitrous parents.³⁵ The diseased condition of this gland in the mother interferes with the course of development in the embryo. How it does so is not known, but the checked cerebral growth would almost seem to indicate that the mother's goitre sympathetically affected the foetal thyroid at a time when it performed a necessary part in the development of the higher nerve centres or at about the time the organism would be passing the amphibian stage.

The question of the etiology of neoplasms has been a fruitful source of ingenious speculation for many years. Of late it has received extra stimulation owing to the deaths of two such well-known men as General U. S. Grant and the late Emperor Frederick of Germany from cancer. It will probably be long before a consensus of opinion obtains in a matter so involved and obscure, but the tendency of accumulating facts seem to point toward the doctrine of descent for the best solution to the mystery. We have already discovered the source of many cystic tumors in sealed up obsolete canals, where a small unoccluded, cavernous spot, by reverting to its ancient habit of secreting, was at the bottom of the trouble. Allow me now to quote a passage from Wagner upon epithelial cancer that will at once shed more light upon another class. He says: "It may happen that epithelial germs of the

³⁵ Reference Handbooks of the Med. Sciences, vol. 3, p. 350; Quain's Dict., p. 538.

horny layer, as well as of intestinal glandular layer, reach by a pathological process into the deep structures, in which they lose every connection of the epithelial matrix by constriction; here, like the enamel germ destined for the permanent tooth, they may remain latent for years, without losing their capacity for development."³⁶ What in lower forms of life would have developed into perfect glands of many kinds may in the higher foetus be rolled into and made fast in the deeper structures. Their latent potency may be stirred up sympathetically, vicariously or by irritation, and cause them to try among distorting difficulties to restore their lost forms and functions, thus giving us burrowing cancers. In other words, they are attempts at reversion to primitive types under conditions unfavorable to such reversion. The favorite seats of such growth will be near points of union of unlike tissues. It is a well known fact that the reparative or proliferating force of the cells of animals varies inversely as their specialization.³⁷ Cut a polyp, and each piece will grow a new body. Cut a lobster's leg off and it will grow out a new leg. Cut a man's finger and he has only power to restore comparatively a mere speck with scar tissue. The older a man is the less his reparative power? Does this power of the foetus compare in its successive stages of development with that of the animal's whose specialization they represent at these stages? No one knows. We can infer from the fact that the power increases inversely as age, that it probably does. Even in old age an irritated injury will give out exuberant granulations on normal tissue. The connective tissue of a jelly fish has an indefinite power of proliferation. If a few of the connective tissue cells of a two weeks' foetus should be arrested in their development while the rest of the body went on to ordinary perfection would they, like enamel germs, hold for years the latent power of their excessive proliferation? We do not yet know how far back arrests of this kind occur, but we do know that they are common during various stages. Virchow has demonstrated such unconverted elements in a number of tissues. In the evolution of bone from cartilage we can see the process plainly. Numerous little isles of cartilage cells can often be found in adult bones that have never gone on to the production of true bone. Cohnheim declares these to be the foundation of most neoplasms, and Mr. Sutton, in the Erasmus Wilson lectures on Evolution before the Royal College of Surgeons, says of such tumors that "they are always confined to regions of the body where the elements of which they are composed are to be unequivocally demonstrated."³⁸ Reversion to the ancestral

³⁶ Wagner's Pathology, p. 486.

³⁷ Phila. Med. Register, vol. 2, p. 542.

³⁸ Lancet, Feb. 27th, 1886, p. 386.

function of such arrested cells becomes our most plausible theory of the production of the majority of cancerous growths. In the lower animals the ordinary repair tissue often goes on to a most abnormal extent. Should we then wonder that cells of the same type, carried up from the *fœtus* to the man, should act in a somewhat similar manner?

It is now about time for pathology to seek to put itself upon a scientific basis by attempts at broad generalization. Year after year the papers of our societies and medical journals are crowded with reports of cases, curious and common, but rarely does any one try to bring them together and seek to get a meaning out of them. Why should we continue carrying grists to mills that cannot or will not grind, or building-material for houses no one endeavors to build? Case on case is piled mountain high in inextricable and abominable confusion, and no one is any wiser as to what it all means. What if we are caught slipping sometimes in our theories? They stir up thought and instigate to investigation. Show me a man that thinks he never theorizes, and I will show you one who never added an iota to the sum total of valuable human knowledge, and who never will till he rids himself of his foolish conceit. Prof. Pye Smith in his presidential address before the biological section of the British Association for the Advancement of Science a few years ago, said: "The progress of therapeutics is to be marked, not by the labors of 'practical men' (who, by the way, are of all the most theoretical, only that their theories are wrong), but by the, at first sight, unconnected studies of Des Cartes and Newton, of Hooke and Grew, of Lavoisier, Davy and Volta, of Marshall Hall and Johannes Muller."³⁹ There is not a doubt of this. Chemical, botanical, electrical and physical theories that physicians as such had nothing to do with, have led to all our substantial progress in therapeutics. May we not now hope that the speculations of Lamark and Darwin, Spencer and Wallace, Huxley and Morse, Mivart and Haeckel, with those of Cope, Lankaster, Dollinger and Klein, may yet do as much for pathology?

DISCUSSION.

Dr. PILCHER.—It seems to me that such a paper as that which we have had the pleasure of listening to this evening, one that evidently is the result of much thought, and that is likely to stimulate thought to such an extent, should not be permitted to pass without some discussion, without some attention being shown to it by this Society, even if that should be nothing more than the expression of a feeling of dis-

³⁹ Nature, vol. 20, p. 409.

sent. I had hoped that some of my older brethren, of whom I see so many—some of whom we know to be able to cope with such a question—might have been willing to have given us the benefit of their own thought and of their own information.

However, I would not be willing, personally, that a subject such as this should be permitted to pass with no expression of opinion as to its merits. I do not feel called upon in any way to discuss the general subject of the doctrine of evolution; but it does seem to me, if this doctrine be true, then some of the views of human life and human experience and human anatomy that have been given here to-night might possibly be called in question, although they have been presented in so striking and interesting a manner. Some of the views that have been presented to us this evening seem to me to be in direct antagonism with the truth of the theory from which they have been evolved and upon which they are based. If the law of the survival of the fittest, the great law of Mr. Darwin, be the law which has determined the evolution of one phase of life after another, then the fearful evils which are described as attending the man going upright should have caused him long ago to have perished from the face of the earth, as certainly, if we are to believe the statements of the speaker to-night, they are likely soon to do. It has been very clearly proven to us, if we accept the premises of the speaker, that the human race must very soon become extinct, or that it must adopt the quadrupedal condition. If this is true, how is it then, from the doctrine of evolution and the survival of the fittest, that the first one who was venturesome enough to rise from the four-footed state to walk with his head erect, could have escaped the condemnation which is now hastening to come upon us all.

I remember my attention being called, when I was quite a lad, to the Bridgewater treatises, and the wonderful manner in which Paley and Sir Charles Bell and others, who were authors of these treatises, undertook to prove the omnipotent and omniscient plan of the universe, from created things, and especially from the manner in which man had been formed and fitted for his particular work here upon earth; and yet it would seem that they are all wrong, that even diabolical machines or traps have been set in the arrangement with which we have been endowed; which are explicable upon the doctrine of evolution, but are to be condemned as infernal, if the teaching of the Bridgewater treatises be the true one. It may be so. At the same time, it has seemed to me that this thought might be suggested—that it would be the worst thing which could happen to us if we were to live forever, and that one of the greatest blessings that comes to us is that there are these little weaknesses in our frames that may shorten our existence, and enable us to be translated to another sphere; if that

is the case, they may not be such a terrible thing after all. There may be some explanation, from that point of view, for these little loopholes, which a critic may find here and there in our anatomical arrangements, whereby it is possible for the machinery to get out of order and for us to be broken to pieces.

I have enjoyed, extremely, listening to the earnest and fruitful remarks of the speaker, and I believe we will all feel under obligations to him for having quickened our thought. We have been in the habit here of listening to dry and sometimes not particularly profitable accounts of individual cases, and it is a refreshing thing to have an attempt made to bring us up to a broader and a higher point of view.

Dr. BUNKER.—If I were one of the gentlemen disposed to deny the Doctor's premises, and to feel shocked at his conclusion, I should still wish to declare myself profoundly impressed by the essay which he has given us to-night. It seems to me emphatically the right kind of work. I feel that we are honored that such work is brought before us. My own preference is to listen to the other side; I feel myself very much on Dr. Eccles' side. I think his premises are pretty nearly incontrovertible, and his conclusions are certainly very interesting indeed.

As the Doctor will probably sum up, later in the evening, it occurs to me to suggest to him, *apropos* of his discussion of the relations of the thyroid gland and cretinism, the recent studies of various anatomists and pathologists with reference to the relation of the thyroid gland to tetany. In view of the fact that both cretinism and tetany point to chronic disease of the central nervous system, while in both there is found a striking coexistence of structural changes in the thyroid, I trust the Doctor will find my suggestion germain, and will give the matter his attention in closing the discussion.

Dr. HOPKINS.—Mr. President, I came here especially to listen to the paper which will occupy the latter part of the evening; but I may say that I have been exceedingly interested in this paper; it shows the result of much study, and it certainly ought to excite a great deal of interest. But, as I have followed the Doctor in the course of his paper, I do not feel prepared to discuss it fully. He has adopted, in my estimation, a great many false premises; he has reasoned from a great many false positions.

The gentlemen who reason upon this plan ask you to accept certain things which they cannot prove. When they get that acceptance, then they can prove everything; that is the trouble with a specious argument of this kind. I am not prepared to take it up, but I do positively enter my protest against the acceptance of such views, and I think they admit of entire refutation.

Dr. FOWLER.—Like the last speaker, I have not given this subject much attention; but it seems to me we might go on for the entire evening, and for the time allotted to these meetings for many evenings, in the discussion of the problem of evolution, and be no nearer to a rational conclusion at the end of that time than at the present. I think the subject is entirely too vast to cope with in an ordinary meeting of a society of this kind, and unless some special time is set apart, I imagine it cannot be at all profitable.

Dr. HARCOURT.—I may say I have listened to the paper with a great deal of pleasure and profit, and I consider it a very interesting one. It strikes me that the subject has not been sufficiently emphasized, and it has not received that strong endorsement from writers that its importance deserves. I am surprised to hear some of the gentlemen here say that the Doctor draws wrong conclusions.

I can endorse every proposition he mentions; I believe in it. He has mentioned facts, and anatomical facts, and until these are disproved, it is time enough for gentlemen to say he has drawn wrong conclusions.

In regard to the relation of descent to disease, I don't see how any rational person can doubt such a theory.

Let us take up one of the ordinary things that we meet with daily; take the case of consumption: An eminent physician in England has found, out of 1,000 cases, 12 per cent. inheriting a predisposition towards the disease, and 48 per cent. manifesting what he calls family predisposition. He defines *hereditary* predisposition as that where the parents are afflicted with the disease of the patient, and *family* predisposition, that where some of the remote ancestors were afflicted with the same disease. In fact the laity, who know nothing about disease except its inconvenience, are very well satisfied that consumption runs through a family.

Take the case of cancer. When a patient comes to consult you concerning a hard painful tumor of slow growth, adherent, or perhaps a soft ulcerating tumor, the diagnosis of cancer will at once suggest itself to you, and you are pretty sure to make inquiries whether any of the patient's ancestors or parents had such a disease. If so, we are pretty certain of arriving at a positive diagnosis, with the assistance of the microscope.

Take the case of syphilis: I do not suppose there is anybody here who has not had cases of children who manifested the disease, on account of the parents being afflicted with it. I recollect seeing it in a child seven years old. The father had been a dissipated man, the mother had contracted it from him, and it showed itself afterwards in

the child. I don't see how it could be otherwise, considering the way the blood must be contaminated with the poison ; and it is almost impossible for the woman to have children without their being afflicted the same way.

I think the paper is a valuable one, and one that will cause us to think ; and I feel safe in endorsing every one of his premises and conclusions.

Dr. ECCLES.—It is unfortunate that the debate has taken the present trend of defending or opposing evolution as a doctrine. The paper of the evening purposely steers clear of this, and merely undertakes to show that as a working hypothesis, *whether true or false*, it is the best at our command. In fact no other is offered as a substitute, our choice being evolution or nothing. It points out the fact that in chemistry, botany, zoology, and even astronomy, its power as a guide to discovery has been simply marvellous, and the question is asked : "Can it not be utilized in the domain of pathology with equal effectiveness?"

Dr. Pilcher's position, if designed as a blow at Darwinism, is not well taken. Were I here to defend that doctrine as true it would be easy for me to point out in reply that the objection he raises resolves itself into a question of weights or measures. Having a pair of scales with a large weight on one side and many small ones on the other, the aggregate gravific power of all the small ones must exceed that of the large one before the beam turns. Dr. Pilcher, to sustain his position in a proper manner, should be able to show that the disadvantages of the upright position weigh more in the struggle for existence than the advantages. The paper of the evening did not have to deal with the latter phase. Whether extinction occur at all, or with what speed it would occur, depends entirely on the ratios of weights in the two scale pans. Evidently the Doctor has lost sight of the double-sidedness of the problem. Pathology only deals with disadvantages, but philosophy should draw a balance between advantages and disadvantages.

Paley's Bridgewater Treatise was all right as far as it went. Nature's adaptations are wonderful indeed, and much more so than any one dreamt of when it was written. The facts referred to to-night were unknown to Paley, so that if he had wanted to show failures of adaptation instead of fitness, he could not have presented these.

I thank Dr. Bunker for his reference to the connection of tetany with enlargement of the thyroid gland, the fact being new to me.

Dr. Hopkins gives us to understand that my premises are all wrong and my conclusions thereby vitiated. Since false premises can only lead to false conclusions, he refuses to grant the former and

thereby avoids entanglement in the latter. He failed to show which premises he meant or what conclusions he referred to. With considerable warmth he protested against such heresies, and declared his belief in the possibility of their entire refutation. The Doctor evidently misunderstood me. He thought I was defending evolution. Whether true or false, this hypothesis has worked wonders so vast that really it is bewildering to the intellect to attempt to grasp them as a total. Myriads upon myriads of discoveries have been made by its aid in all departments of science. Why not use it in pathology and see if it can not be made as useful there as in other places? Take it as you would a machine to do your work. Never mind whether you believe or disbelieve it. Is Dr. Hopkins willing to use it as a mere labor-saving device and means of discovery, or will he reject it as so many human fossils rejected steam looms and spinning machines, because they believed them to be inventions of the devil? Like a railroad train, it can carry us beyond the frontiers of present human knowledge with great swiftness. Will Dr. Hopkins get on board with me, or will he refuse to do so for fear of patronizing a device of Satan?

